भारतीय मानक
Indian Standard

IS 17931 : 2022

पॉलिमर सामग्री की पैकेजिंग के लिए पोलीइथाइलीन से बने फॉर्म फिल सील बैग — विशिष्टि

Form Fill Seal Bags Made from Polyethylene for Packaging of Polymer Materials — Specification

ICS 83.080.20

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Plastics Packaging Sectional Committee, PCD 21

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Plastics Packaging Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

Bags made of single-family polyethylene films are being used widely for packing granular and dry powdered material in bulk quantities. These bags are manufactured using multilayer tubular film, to achieve a very high production rate during the packaging process. These bags are majorly used in Form, Fill, Seal (FFS) process and to some extent in the offline filling process. Outstanding advantages of the FFS system for the value chain have made these FFS bags the most preferred heavy-duty shipping bags followed by plastic woven fabric bags and multilayer paper bags.

This standard is being prepared taking into consideration the increased use of heavy-duty polyethylene film bags for bulk packaging of polymer raw materials. These bags are leakproof and have the advantage of being resistant to moisture ingress, pilferage-proof packaging, better stackability, and better aesthetics.

The objective of this standard is to guide the film manufacturers and the polymer manufacturers and the user of film bags for packaging, in specifying the material of construction, film performance criteria, bag dimensions and, bag performance criteria to their mutual benefit.

The composition of the Committee responsible for the formulation of this standard is given in Annex G.

For deciding whether a requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

FORM FILL SEAL BAGS MADE FROM POLYETHYLENE FOR PACKAGING OF POLYMER MATERIALS — SPECIFICATION

1 SCOPE

This standard prescribes the requirements of polyethylene films and the bags made thereof, for the packaging of polymer materials, which are in granular form or in dry powder form.

2 REFERENCES

The following Standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

IS No.	*Title*
196 : 1966	Atmospheric conditions for testing
2508 : 2016	Polyethylene films and sheets — Specification (*third revision*)
2798 : 1998	Methods of test for plastics containers (*first revision*)
4905 : 2015/ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
7328 : 2020	Specification for polyethylene material for moulding and extrusion (*second revision*)
10146 : 1982	Specification for polyethylene for its safe use in contact with foodstuffs, pharmaceuticals and drinking water
11342 : 1994/ ISO 6591-2 : 1985	Packaging — Sacks made from thermoplastic films — Description and method of measurement (*first revision*)
11343 : 2004/ISO 6590-2 : 1986	Packaging — Sacks made from thermoplastic films — Vocabulary (*first revision*)
13360	Plastics — Methods of testing
(Part 3/Sec 10) : 2021/ISO 1183-1 : 2019	Physical and dimensional properties, Section 10 Determination of density of non-cellular plastics — Immersion method, liquid pyknometer method and titration method (*first revision*)
(Part 3/Sec 11) : 2021/ISO 1183-2 : 2019	Physical and dimensional properties, Section 11 Determination of density of non-cellular plastics — Density gradient column method (*first revision*)
(Part 4/Sec 1/Subsec 1) : 2018/ISO 1133-1 : 2011	Rheological properties, Section 1 Determination of the Melt Mass-Flow Rate (MFR) and the Melt Volume-Flow Rate (MVR) of thermoplastics, Subsection 1 Standard Method (*first revision*)
(Part 4/See 1/Subsec 2) : 2018/ISO 1133-2 : 2011	Rheological properties, Section 1 Determination of the melt Mass-Flow Rate (MFR) and the Melt Volume-Flow Rate (MVR) of thermoplastics, Subsection 2 Method for materials sensitive to

IS No.	*Title*
	time-temperature history and/or moisture (*first revision*)
(Part 5/Sec 1) : 2021/ISO 527-1 : 2019	Mechanical properties, Section 1 Determination of tensile properties — General requirements (*second revision*)
(Part 5/Sec 3) : 2018/ ISO 527-3 : 1995	Mechanical properties, Section 3 Determination of tensile properties — Test conditions for films and sheets (*first revision*)
(Part 5/Sec 6) : 1999/ISO 7765-l : 1988	Mechanical properties, Section 6 Determination of impact resistance by the free-falling dart method — Staircase methods
(Part 5/Sec 23) : 1996/ISO 6383-2 : 1983	Mechanical properties, Section 23 Determination of tear resistance of plastics film and sheeting — Elmendorf method
(Part 9/Sec 5) : 1999	Optical properties, Section 5 Determination of haze and luminous transmittance of transparent plastics
(Part 11/Sec 1) : 1999/ISO 8295 : 1995	Special properties, Section 1 Film and sheeting — Determination of coefficients of friction

3 GENERAL TERMS AND DEFINITIONS

For this standard, the following terms and definitions shall apply:

3.1 Plastic Film Bag — A container made essentially from a flattened tubular film of polyethylene flexible film as described in IS 2508, closed at least at one end or closed at both ends with a valve for filling of material.

NOTE — Hereafter where the word bag, FFS bag, or heavy-duty bag is used in the text of this standard, the fabricated bag made from polyethylene film is to be understood. If no prefix is applied to a term under the definition, it is to be understood as an FFS bag.

3.2 Flat Film — A thin flexible film made of polyethylene material in the form of a flat ply. The film shall be of a multilayer construction.

3.3 Tubular Film — A thin flexible film made of polyethylene material in the form of a cylindrical tube. The film shall be of a multilayer construction.

3.4 Ply — A flat or tubular film of polyethylene material, used for forming the walls of the bag.

3.5 Tube — Flexible film in the form of a flattened cylinder. The tubular film may be a circular seamless film produced on a blown film plant or a flat film fabricated into a cylindrical tube by the longitudinal overlap of film edges and joined to form a center seal tube using heat sealing, ultrasonic welding, and hot air welding or combination thereof. The bags produced from a flat film and fabricated into a cylindrical tube by the longitudinal overlap of film edges and joining are known as centre seal bags.

3.6 Flatten Tubular Film — A tube comprised solely of flattened cylindrical plies with or without gusset.

3.7 Gusset — A fold inserted in the longitudinal edge of a tube or bag.

3.8 Gusseted Tube — A tube with folds inserted in the longitudinal edges.

3.9 Longitudinal Overlap — Areas of the longitudinal edge of a flat ply which are superimposed for joining to form a center seal tube.

3.10 Transverse Overlap — Areas of cut tube ends which are superimposed for transverse joining to form a bottom and top closures.

3.11 Joining — Bonding together of ply or tube to form a bag. The bonding process can be heat sealing, hot air welding, radio frequency or ultrasonic welding.

3.12 Transverse Joining — Joining of transverse overlap ends of the cut tube at one end or both ends to form a bottom and top closure of the bag. The width of the seal line typically varies in the range of 2 to 6 mm, as per requirement.

3.13 Gusseted Bag — A bag manufactured from a gusseted tube.

3.14 Open Mouth Bag — Tube closed at the bottom end with an open top. An intermediate product of bag fabrication process.

3.15 Seal Strength — Force per unit width of seal required to progressively separate two flexible films through the seal or joint, under the conditions of the test.

3.16 Form Fill Seal (FFS) Process — A type of automated assembly-line product packaging system, commonly used in the bulk packaging industry. It consists of a vertical form fill seal machine which converts the flat or tubular film into a bag by first forming bottom closure and then filling the bag with material, followed with sealing of open mouth of the bag to form a top closure and discharge of filled bag from the filling station.

3.17 Hot Seal Strength (Hot-Tack) of Film — Hot seal strength is a measure of the strength of a heat seal, tested immediately after sealing and the seal is in hot condition. During the high speed FFS packaging process, the newly formed hot seals are frequently exposed to disruptive forces, such as when contents are dropped into the bag. These forces act on the hot seal and if there is inadequate resistance the entire seal or part of the seal can break.

3.18 Film Perforation — Holes pierced through the flexible film walls of the bag to facilitate the release of displaced air from the bag during the material filling process. The hole size and shape shall be designed in such a way that the inside material is protected from the outside environment.

3.19 Film Embossing — A process typically conducted on bag walls using a set of patterned knurling rolls, in which a pattern of points or straight, angled lines is rolled on the plastic bag walls to improve bag to bag cohesion and thus enhance stackability during storage or transport. Generally, length way continuous bands, typically of 40 to 80 mm width are embossed on both sides of the film tube.

3.20 Film Haze — The cloudiness or opacity in a transparent film or the portion of the light that is not transmitted through a film in a straight line.

3.21 Film Openability — Ability of tubular flattened film to open easily during the bagging process for material filling. Plastic films tend to adhere together, often making it difficult to separate layers. Film openability is improved by the addition of anti-blocking additives.

3.22 Coefficient of Friction (COF) Property of Film — The ability of film to slide smoothly on guiding rolls without any slip-stick effect during the bagging process is determined by COF property. Slip additive is added to polymer during the film extrusion process to decrease COF and to improve film sliding property.

3.23 Surface Treatment of Films — The ability of polymer films to retain printing ink is primarily governed by the character of their surfaces and can be improved by one of several surface-treating techniques.

For additional terms and definitions, IS 11342 and IS 11343 may be referred.

4 MANUFACTURE

4.1 Raw Material

4.1.1 Primary raw material used for manufacturing film shall consist of Linear Low Density Polyethylene (LLDPE), and Low Density Polyethylene (LDPE) according to IS 7328. However High Density Polyethylene (HDPE) as per IS 7328 may or may not be used depending upon the functional requirement of a bag packed in form fill seal machine (FFS). To achieve desired film properties, the combination of various types of polyethylene, such as High density polyethylene (HDPE), Linear low density polyethylene (LLDPE), Low density polyethylene (LDPE), and polyolefin based plastomers may be used.

4.1.2 Melt Flow Index (MFI) of polyethylene raw material shall be as agreed to between the buyer and the seller, and, shall be in the range 0.02 to 4.0 g/10 min when determined in accordance with IS 13360 (Part 4/Sec l/Subsec 1) or IS 13360 (Part 4/Sec l/Subsec 2) under test conditions 190 °C temperature and 2.16 kg load.

4.1.3 Density of polyethylene raw material shall be as agreed between the buyer and the seller, and, shall be in the range 913 to 957 kg/m^3 at 27 °C and 915 to 960 kg/m^3 at 23 °C when determined in accordance with IS 13360 (Part 3/Sec 10) and IS 13360 (Part 3/Sec 11).

4.1.4 Antioxidants, slip, antiblock, antistatic, UV stabilizer additives and colour pigment masterbatch may be used in the manufacturing of film. Polyethylene raw materials used for the manufacture of masterbatch may include copolymers of ethylene and higher olefins with density 910 to 930 kg/m^3 at 27 °C, in which the higher olefin constituents does not exceed 10 percent (m/m).

4.2 Film Manufacturing

4.2.1 *Thickness and Mass* — Film used in the manufacture of bags shall be multilayer and in tubular film form or flat film. For packing granular material, the film shall have a minimum thickness of 120 microns when measured as mentioned in Annex A. The minimum mass shall be 111 grams per square meter (GSM) when measured following the procedure given in Annex B-2.

4.2.2 *Visual Observation* — Film shall be uniform in texture and finish, with no visible defects, such as holes, tears, or blisters. The film shall be free from pinholes, streaks, particles of foreign matter, and gauge variation bands. The film shall show no impression of handling on the surface of the film. The film shall have a uniform and wrinkle-free surface, good film openability, and good heat-sealing properties. As agreed between buyer and seller, the film shall be defined for colour and haze (opacity). For polymer packaging application, white colour films with a minimum haze value of 80 percent is commonly used.

4.2.3 *Film Embossing* — Smooth surface of plastic film bags have lower Coefficient of Friction (COF) and therefore, has difficulty in stacking filled bags due to sliding tendency. Embossing effect on the bag walls using a set of knurling rollers may be employed to enhance inter bag cohesion. Alternately, the application of glue or varnish overcoat on the outer surface of bags or any other suitable methods to improve inter bag cohesion may be employed. The embossed pattern on the bag walls shall be performed from inside to outside so that the raised embossed pattern is on the outer side of the bag walls. Type of embossed pattern, embossed size, shape, and embossing density per unit area, may vary depending on the desired stackability and shall be specified as agreed between buyer and seller.

4.2.4 *Surface Treatment of Films and Printing* — Electrical discharge treatment, such as corona treatment, has been found to increase the wetting tension of a polymer film and its ability to accept and retain printing ink. The film tube shall be surface treated sufficiently to achieve desired treatment level for better ink adhesion and printing quality. The film shall be printed in mono or multicolor using flexography, gravure, or digital printing process. The normal range of surface treatment is 36-44 dynes/cm.

4.2.5 *Film Roll Packing* — The flatten tubular film produced shall be wound and supplied to FFS bagging units in the form of neatly and firmly wound rolls. The film rolls shall have clear edges and be free from telescopic winding. The film rolls shall be packed and labelled as agreed to between the buyer and seller. Each individual roll shall be packed using suitable protective covering such as foam sheet, corrugated paper sheet, stretch wrap film or a combination thereof to prevent damage. Edge protectors may also be used wherever necessary to avoid film damage. The film roll is an intermediate product of the FFS bag fabrication and bagging process.

4.2.6 *Storage Condition* — Film rolls shall be stored in a ventilated, cool and dry place, covered warehouse at a temperature below 40 °C, and protected from direct sunlight, smoke, fumes, open flame, and radiation.

5 CONSTRUCTION

5.1 Material Holding Capacity of Bag

The bag shall have a nominal capacity of holding 25 kg material.

5.2 Bag Design

A tubular gusseted bag with bottom end and top end closures is the commonly used bag design for the online FFS packaging process and is considered for this standard.

The length, width, and gusset depth of the bag shall be according to the dimensions of the FFS forming and sealing system, bulk density of polymer material to be filled, and the type of material (powder or granular) to be filled. The tolerance in length, width, and other dimensional parameters of the bag shall be in accordance with the acceptable limits given in **7.4**.

The gusseted flattened tubular film of desired cut length is closed at both ends by transverse overlapping of tube ends followed with transverse joining as shown in Fig. 1, as top weld and bottom weld. Primarily these bags are closed at the bottom and then filled from the open top mouth and therefore are without a side filling valve. The bag formation during the FFS process is described in **5.5**.

5.3 Dimensional Designations of Bag

This part of the standard specifies a method for measuring and expressing the dimensions of empty bags as shown in Fig. 1. The dimensions in millimeters shall be specified for various dimensional designations as given in **5.4**, when measured as mentioned in Annex B-1.

5.4 Description for Dimensional Designations of Bag

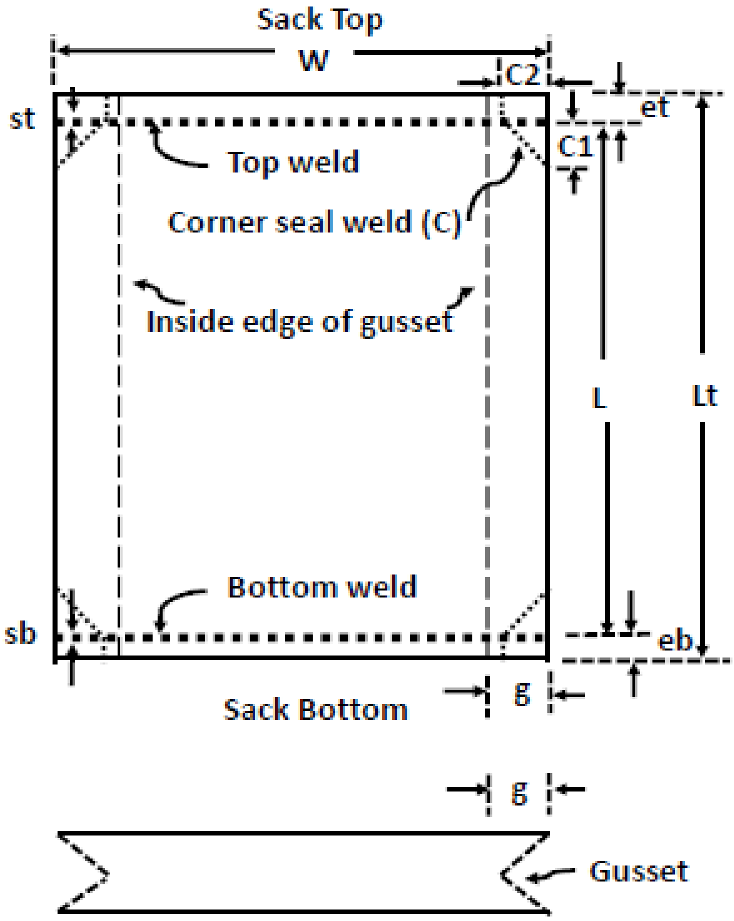
5.4.1 *Total Bag Length (Lt)* — Distance between the top edge and bottom edge of the bag. Total bag length (Lt) is the total of (et + L + eb).

5.4.2 *Bag Length (L)* — Distance between the transverse, top and, bottom weld lines of gusseted bag, measured at the center, perpendicular to the bottom.

5.4.3 *Bag Width (W)* — Distance between longitudinal edges of the gusseted bag, measured at the center, parallel to the bag bottom.

5.4.4 *Gusset Depth (g)* — Width of fold inserted in the longitudinal edges of a gusseted bag.

5.4.5 *Corner Seal Weld (C)* — Diagonal seal weld at four corners of the bag. The slanting length of the diagonal seal weld is determined by the gusset depth and is defined by C_1 and C_2. Diagonal weld seal at bag corners facilitates the formation of flat top and flat bottom for filled bags, comparable to brick type structure.



Keys:

Total bag length (Lt); bag length (bottom weld to top weld) (L); bag width after gusseting (W); gusset depth (g); corner seal weld (C1and C2); top end strip (et); bottom end strip (eb); thick dotted line indicate transverse seal weld line width, (st) for top weld and (sb) for bottom weld.

FIG. 1 DIMENSIONAL DESIGNATIONS OF GUSSETED BAG WITH TRANSVERSE SEAL CLOSURES FOR ONLINE FFS PROCESS

5.4.6 *Weld Line Width(s)* — Width of transverse weld line at bottom closure (sb) and at top closure (st).

5.4.7 *End Strip Length (e)* — Distance between the transverse bottom weld line and bottom edge (eb) and, transverse top weld line and top edge (et), measured at the center, parallel to the bag length. The end strip length (e) also includes the weld line width (sb) for bottom end strip length and (st) for top end strip length.

5.5 Description of Bag Formation Process

5.5.1 The bag shall be formed, filled, and sealed on the form, fill, and sealing machine. Film bags shall be produced from flattened tubular gusseted film, cut to the required length. The bag essentially shall be closed across the bag width at the bottom and top ends to form closures.

5.5.2 During the online FFS process, the tubular gusseted film in roll form is unwounded from the roll and is formed into an intermediary, open mouth bag by first forming bottom closure with an open top. These bags are then filled online with the predetermined quantity of polymer product and subsequently sealed at the top end to form the top closure. The bags are filled with material, leaving adequate headspace in the bag for sealing operation.

The entire FFS process takes place in a continuous mode and consist of several stages includes unwinding of film from the roll, intermediary bag formation with bottom sealing, product filling from the top end, sealing of top end to close the filled bag and, discharge of filled bag from filling station on to the release conveyor belt. During the bag fabrication process, the film tube shall be able to unwind easily, open easily, slide smoothly on guiding rolls, and weld effectively to form durable and leak-proof closures.

6 SPECIMEN CONDITIONING

The film specimens shall be conditioned for a minimum of 24 h to moisture equilibrium from the dry side in the standard atmosphere of 65 ± 5 percent relative humidity and 27 ± 2°C temperature as laid down in IS 196, prior to testing.

7 REQUIREMENTS

The bags shall conform to the following requirements:

7.1 Material holding capacity

The material holding capacity of the bag shall be 25 kg.

7.2 Film Thickness

The film thickness shall be as agreed between buyer and seller, however, shall not be less than 120 microns (**4.2.1**). The film thickness shall be measured in accordance with Annex A. The tolerance on film thickness at any given point and the average thickness of polyethylene film for various thicknesses shall be ±8 percent for peak to peak and ±5 percent for average thickness.

7.3 Bag Dimensions

The bag dimensions may vary as per the bulk density of polymer to be packed and shall be as agreed between buyer and seller. Bag dimensions such as total bag length (Lt), bag length (L), bag width (W), gusset depth (g), corner seal weld (C); top end strip (et); bottom end strip (eb); transverse weld line width, (st) for top weld and (sb) for bottom weld, shall be measured as per the procedure described in **Annex B-1**. The measured dimensions and tolerance shall comply with the specified dimensions.

i) Tolerance on total bag length, mm

The tolerance on total bag length shall be as given below:

700 mm and up to 900 mm — ±10 mm

ii) Tolerance on bag width, mm

The tolerance on bag width shall be as given below:

350 mm and up to 600 mm — ±5 mm

iii) Tolerance on gusset depth, mm

The tolerance on gusset depth shall be as given below:

Up to 80 mm — ±3 mm

iv) Gusset offset, mm

The gusset offset, defined as the difference in gusset depth of the top and bottom layer of the gusseted tube measured at the linear edge when superimposed one above the other, shall not be more than 3 mm.

v) Tolerance on the top end strip (et) and bottom end strip (eb) shall be ±3 mm.

vi) Tolerance on transverse weld line width, (st) for top weld, transverse weld line width, (sb) for bottom weld, and corner seal weld (C) shall be ±1 mm.

7.4 Mass of Bag

The mass of the empty bag may vary with bag dimensions and shall be determined by the actual weighing of the empty bag using a suitable weighing scale, accurate to the ±0.5 g. The mass of the bag shall also be determined by the method described in Annex B-3. The tolerance on the mass of the bag shall be ±3 percent.

7.5 Performance Requirements for Film

7.5.1 *Visual Inspection* **—** The visual inspection parameters shall be prior defined and agreed upon between buyer and seller. The film used for making bag walls shall be uniform in colour, texture, and finish. The film shall be free from pinholes, fisheyes, gels, un-melted polymer streaks, and particles of foreign matter. There shall be no other visible defects, such as holes, tears, blisters, wrinkles, or black dots. Film sample selected for testing of properties given in **7.5.2** to **7.5.9**, shall be visually inspected for any defects and shall be free from folds, creases, perforations, and embossing.

7.5.2 *Haze* **—** The haze or opacity of polyethylene film when tested as per IS 13360 (Part 9/Sec 5) shall be 80 percent, minimum. The test specimen shall be a disc shape of 50 mm in diameter or a square with 50 mm sides. The specimen shall be free of dust, scratches, voids, or any visible defects. Film haze varies with film thickness and colouration.

7.5.3 *Coefficient of Friction* — The dynamic coefficient of friction for the film, when tested in accordance with the test as prescribed in IS 13360 (Part 11/Sec 1), shall be ≥ 0.4. The test shall be carried out on the outer surface of the film and shall be mentioned in the test report. If desired by the buyer, the coefficient of friction for the film to film may also be determined and reported.

7.5.4 *Ash Content* —The film, when tested for ash content in accordance with the test procedure given in Annex C, shall not be more than 2.2 percent.

7.5.5 *Tensile Strength at Yield* — The tensile strength at yield of the film when tested in accordance with the test procedure given in IS 13360 (Part 5/Sec 1) and IS 13360 (Part 5/Sec 3), shall be ≥13 MPa (132 kgf/cm^2) in the lengthwise direction and in the crosswise direction.

7.5.6 *Nominal Tensile Elongation at Break* — The Nominal tensile elongation at break of the film when tested in accordance with the test procedure given in IS 13360 (Part 5/Sec 1) and IS 13360 (Part 5/Sec 3), shall be ≥700 percent in the lengthwise direction and ≥750 percent in the crosswise direction.

The test specimen for tensile strength at yield and nominal tensile elongation at break shall be strip-shaped with 15 mm width and 150 mm minimum length. The gauge length marks shall be 50 mm ± 1 mm apart and approximately equidistant from the midpoint. The initial distance between grips shall be 100 mm ±5 mm (refer to Specimen Type 2 of IS 13360 (Part 5/Sec 3)) and the tensile testing speed 500 mm/min. At least 10 specimens each, shall be tested for lengthwise and crosswise directions.

7.5.7 *Dart Impact Resistance* — The dart impact failure load of polyethylene film when tested in accordance with the test as prescribed in Method A of IS 13360 (Part 5/Sec 6), shall be ≥660 gf for 120-micron thickness film. For film thickness higher than 120 microns, the dart impact strength of film shall comply to 5.5 gf/micron of film. Test method A employs a dart with 38 mm ±1 mm diameter hemispherical head dropped from a height of 0.66 m ± 0.0l m.

7.5.8 *Tear Resistance* —The tear resistance of polyethylene film when tested in accordance with the test as prescribed in IS 13360 (Part 5/Sec 23), shall be ≥960 gf in the lengthwise direction and ≥2 400 gf in crosswise direction for 120-micron thickness film. Tear strength of film shall comply to 8 gf/micron of film for lengthwise and 20 gf/micron of film for width-wise directions. The test specimen shall be of D-shape, constant radius type with a radius of 43 mm, length 75 mm, and the initial slit of 20 mm.

7.5.9 *Heat Seal Strength (Hot-tack)* — The hot-tack strength of film when tested in accordance with the test procedure given in Annex D, shall be greater than 8 N/25 mm. The test specimen shall be strip-shaped with 25 mm width.

7.5.10 *Ink Adhesion Test* — Printing shall be neat and clean without any defects. Printed bags when tested for ink adhesion in accordance with the test method described in IS 2798 and as given in Annex E of this standard, shall not show any significant removal of the print. All prints shall be legible.

7.5.11 *Drop Impact Resistance of Filled Bags* —The filled bags, when tested for drop impact test, according to the method given in Annex F, shall not burst or tear and there shall not be any material spillage from weld seams or from other parts of the bag.

8 STORAGE

All filled bags shall be stored in a ventilated, cool and dry place, covered warehouse at a temperature below 40°C and protected from direct sunlight, smoke, fumes, open flame, and radiation.

9 MARKING

9.1 Marking on Bag

Each filled bag shall be marked or labelled with the following information:

a) Name of the product;

b) Indication of source of manufacturer and address;

c) Bag number and batch number;

d) Month and year of manufacture;

e) Net weight of material packed (kg);

f) Polymer identification code and recycling symbol according to IS 14534;

g) Pictorial symbol for recommended handling and storage instructions; and

h) Any other statutory requirements.

9.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

10 ADDITIONAL REQUIREMENTS FOR ECO MARK

10.1 General Requirement

10.1.1 The product shall conform to the requirements for quality, safety and performance prescribed.

10.1.2 The manufacturer shall produce to BIS the consent clearance as per the provisions of *Water (Prevention & Control of Pollution) Act*, 1974 and *Air (Prevention and Control of Pollution) Act*, 1981 along with the authorization, if required under *Environment (Protection) Act*, 1986 and the Rules made thereunder while applying for the ECO-Mark. The manufacturer shall produce documentary evidence with respect to the compliance of regulation under Prevention of *Food Safety and Standards Act*, 2005 and *Drugs and Cosmetic Act*, 1940 and Rules made thereunder, wherever necessary.

10.1.3 The product must display a list of critical ingredients in descending order of quantity present expressed as a percent of the total. The list of such ingredients shall be identified by the Bureau of Indian Standards.

10.1.4 The product packaging shall display in brief the criteria based on which the product has been labelled as ‘Environment Friendly’.

10.1.5 The material used for product packaging shall be recyclable or biodegradable.

10.1.6 It shall also suitably mention that the ECO MARK label is applicable only to the packaging material/package if the content is not separately covered under ECO MARK. It may be stated that ECO MARK is applicable to the product or packaging material or both.

11 SAMPLING AND CRITERIA FOR CONFORMITY

11.1 The compliance to the present standard comprises performance testing of both, bags and the film used for making bag walls.

11.2 Sampling

11.2.1 *Lot* **—** All bags filled on the FFS machine, if produced using identical construction film and under similar manufacturing conditions shall be grouped together to constitute a lot.

11.2.2 The conformity of the lot to the requirements of the standard shall be determined based on the test carried out on the samples selected from it.

11.2.3 Tests for determining the conformity of the lot to the requirements of specification shall be done on each lot separately. The conformity of the lot to the requirements of the standard shall be determined based on tests carried out on samples selected from it. The bag samples shall be selected at random from the lot for testing purposes. To ensure the randomness of the selection, the procedure given in IS 4905 may be followed. Film test specimens from the bag walls shall be drawn from a middle portion of the selected sample bags and shall be free from creases or any defects.

11.2.4 The number of bag samples to be selected for testing shall be in accordance with col 3 of Table 1 for visual inspection, film thickness, bag dimensions, and mass of bag requirements, and shall be in accordance with the col 4 of Table 1 for tensile strength at yield, nominal tensile elongation at break, dart impact resistance and tear strength requirements. The bag samples shall be selected in accordance with col 5 of Table 1 for the determination of film properties, haze, COF property, ash content, hot seal strength, ink adhesion property, and drop impact resistance of filled bags.

Table 1 Sample Size and Criteria for Conformity
(*Clause* 11.2.4)

Sl No.	**Number of bags in a lot**	**Sample size for visual inspection, film thickness, bag dimensions and mass of bag requirements**	**Sample size for tensile strength at yield, nominal tensile elongation at break, dart impact resistance and tear resistance requirements**	**Sample size for determination of haze, COF property, ash content, hot seal strength, ink adhesion property and drop impact resistance of filled bags requirements**
(1)	(2)	(3)	(4)	(5)
(i)	up to 250 000	4	2	1
(ii)	250 001 to 500 000	8	4	2
(iii)	500 001 to 1 000 000	12	6	3

NOTE — For bags with change in raw material formulation, film thickness, film tube dimensions or print matter, the bags shall be grouped under new lot.

11.3 Criteria for Conformity

11.3.1 The lot shall be considered as conforming to the requirements of this standard if the following conditions are satisfied:

a) The number of samples not complying with visual inspections shall not be more than 1 percent of the sample size.
b) Film thickness shall be as agreed between buyer and seller and comply with the tolerances specified in **7.2**.
c) Bag dimensions shall be as agreed between buyer and seller and shall comply with the tolerances specified in **7.3**.
d) None of the bags weighs less than the respective lower specified limit after allowing tolerance of ± 3 percent on individual bag specified in **7.4**. A higher mass of bag may be accepted.
e) Film haze property shall be as agreed between buyer and seller and shall comply with **7.5.2**.
f) Film COF property shall be as agreed between buyer and seller and shall comply with **7.5.3**.
g) None of the film samples has ash content greater than the specified value given in **7.5.4**.
h) The average values of tensile strength at yield, nominal tensile elongation at break, dart impact resistance and tear resistance are not less than the value specified in **7.5.5** to **6.5.8** and none of the individual test values is more than 10 percent below the specified value.
(j) The average values of hot seal strength of film shall not be less than the value specified in **7.5.9** and none of the individual test values is more than 10 percent below the specified value.
(k) Film printing shall be neat and clean and shall not show any significant removal of printed matter after the ink adhesion test specified in **7.5.10**. All prints shall be legible.
(l) None of the bags shall fail in the drop impact resistance test as specified in **7.5.11**.

11.2.2 The film used for making bags shall be declared as conforming to the requirements of the standard if all test results for different characteristics given in **11.3.1** are found to meet the relevant requirements of the standard.

ANNEX A

(*Clause* 4.2 *and* 7.2)

DETERMINATION OF FILM THICKNESS

A-1 APPARATUS

A dead weight dial micrometer with a flat anvil of 6 mm diameter or larger in the area and 4.8 mm diameter flat surface on the head of the spindle or a spring dial micrometer (dial thickness gauge) which has been calibrated against a dead weight dial micrometer shall be used. In case of dispute, only a dead weight dial micrometer shall be used and the reading shall be taken between 15 s and 2 min after the load is applied.

A-2 SPECIMENS

Test five specimens, at least 100 mm x 100 mm in area, taken uniformly across the width of the bag walls.

A-3 PROCEDURE

Dry and clean the surface of the anvil and spindle head, and of the specimen. Place the specimen on the anvil and lower the spindle head on to it slowly. The total load applied by the spindle shall be 110 g. Make one measurement on each specimen approximately at the centre of the specimen. Take the mean of the measurements of all the specimens of a sample to obtain the average thickness of the sample.

A-4 ACCURACY

This method can produce measurements with a maximum error of +0.002 5 mm.

ANNEX B

(*Clause* 4.2.1, 5.3, 7.3 *and* 7.4)

METHOD OF TEST FOR BAG DIMENSIONAL PARAMETERS, FILM MASS PER UNIT AREA AND MASS OF BAG

B-1 METHOD OF MEASUREMENT FOR VARIOUS BAG DIMENSIONS

B-1.1 Apparatus

Metallic ruler or a suitable measuring instrument graduated in millimeters, and capable of measuring dimensions of tubular film or bag to an accuracy of 1 mm.

B-1.2 Measurement procedure

Lay each bag as selected in Table 1 on the flat horizontal surface of the working table. Render it free from creases and wrinkles and measure total bag length (Lt), bag length (L), bag width (W), gusset depth (g), corner seal weld (C); top end strip (et); bottom end strip (eb); transverse weld line width, (st) for top weld and (sb) for bottom weld, about the middle to the nearest 1 mm. Measure at least 10 samples.

B-1.3 Calculation and expression of results

Calculate the dimensions as the mean of the determinations for each dimensional parameter of the bag as specified in **7.3** and express them in millimeters to the nearest millimeter.

B-2 METHOD OF TEST FOR DETERMINATION OF FILM MASS PER UNIT AREA

Lay each bag as selected in Table 1 flat on a table. Render it free from wrinkles and cut out the film using a 100 mm x 100 mm template from the center portion of the bag walls. Weigh the cut piece sample precisely and compute the mass of film in gram for one square meter (GSM).

B-3 METHOD FOR CALCULATION OF MASS OF BAG

B-3.1 Calculation of mass of the bag

Calculate the mass of bags with the help of the following formula as the case may be:

$$M = (Lt) \times 2\,(W+2g) \times m \times 10^{-6}$$

where

M = mass of bag, in gram;
Lt = total length of the bag, in mm (measured for bottom edge to top edge);
W = width of the bag, in mm;
g = depth of gusset, in mm;

m = mass of film, in gram per square meter (g/m^2);

B-3.2 Report

The calculated mass of the bag shall be reported in gram (g).

ANNEX C

(*Clause* 7.5.4)

DETERMINATION OF ASH CONTENT

C-1 PRINCIPLE

The procedure is used to find out the inorganic residue in the film sample by ashing it in a muffle furnace. A weighed amount of film specimen is heated to 550°C. The polymer content of the sample (organic portion) is burnt at 550°C until a constant mass of inorganic matter is obtained. The residue (inorganic matter) is reported in terms of percentage ash content in each sample.

C-2 TEST APPARATUS

C-2.1 Weighing balance, accurate to 0.001 g, bunsen burner, silica triangle and tripod, silica crucibles (enough volume to accommodate 10 g of sample), crucible holder, gloves.

C-2.2 Muffle furnace, capable of being controlled thermostatically at 550°C ± 10°C.

C-2.3 Desiccator, containing an effective drying agent, such as silica gel, that does not react chemically with ash components.

C-3 TEST PROCEDURE

C-3.1 Clean the crucible and heat at 550°C ± 10°C for 10-15 min and cool it in a desiccator.

C-3.2 Weigh the empty crucible to the nearest 0.001 g.

C-3.3 Weigh nearly 10 g of film sample in the crucible (nearest to 0.001 g).

C-3.4 Heat the crucible directly on the burner so that the sample burns slowly, and loss of ash is avoided. Continue burning until no more smoke is evolved. Necessary care shall be taken to effective venting of smoke. Use of air pollution control devices such as wet scrubbers and electrostatic precipitators for effective filtering and removing of suspended particulate matters, soot and ash from exhaust smoke stream before it exits the smokestack is suggested.

C-3.5 Transfer the crucible in the muffle furnace, which is already maintained at approx. 550 °C and keep it inside for about 2 h.

C-3.6 Remove the crucible from the furnace and cool it to room temperature in a desiccator, weigh it and record the weight to the accuracy of 0.001 g.

C-3.7 Keep the crucible in the muffle furnace for another half an hour, cool in a desiccator and weigh again. Repeat the procedure until the constant mass is obtained.

C-4 REPORT

$$\text{Percent ash content} = \frac{\text{Weight of ash}}{\text{Weight of film sample}} \times 100$$

ANNEX D

(*Clause* 7.5.9)

HOT SEAL STRENGTH (HOT-TACK) OF FILM

D-1 TEST PRINCIPLE

D-1.1 Hot seal strength (hot-tack) tester measures the strength of heat seals formed between thermoplastic surfaces of flexible films, immediately after the seal has been made and before it cools to ambient temperature. This property is important since this situation frequently occurs on vertical Form Fill Seal (FFS) packaging. In this process, the material intended to be packed are dropped into the bag immediately after the bottom seal is made. Since the content can be heavy, around 25 kg in weight, the hot seal must be able to withstand high loads, thus requiring a high hot-tack force.

D-1.2 This test method is restricted to instrumented hot-tack testing, requiring a testing machine that automatically heat seals a test specimen and after the conclusion of the sealing cycle, determines the strength of a hot seal at specified grip separation rate. The measured hot seal strength is plotted against the sealing temperature to determine the maximum hot seal strength (hot-tack) of the film and the sealing temperature range.

D-2 TERMINOLOGY

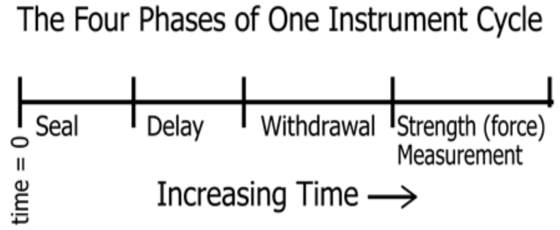
D-2.1 Adhesive Failure — A failure mode in which the seal fails at the original interface between the surfaces being sealed.

D-2.2 Burnthrough — A state or condition of a heat seal characterized by melted holes and thermal distortion. Burnthrough indicates that the sealing conditions (time or temperature, or both) were too high to produce an acceptable seal.

D-2.3 Cohesive Failure — A failure mode where either or both sealed film plies fail by splitting approximately parallel to the seal, and the seal itself remains intact.

D-2.4 Cooling Time — Time in the instrument cycle between the opening of the seal bars and the termination of the peel force measurement.

D-2.5 Cycle — The combination of instrument mechanical and electrical operations automatically performed from initiation of sealing through peeling apart a seal and measuring the hot-tack strength. The cycle can be broken down into four phases:sealing, delay, withdrawal, and peel as shown below.


The Four Phases of One Instrument Cycle
Seal
Delay
Withdrawal
Strength (force) Measurement
time = 0
Increasing Time ⟶

D-2.6 Delay Time — The time interval from when the heat-seal bars open after sealing two film surfaces, to the point at which withdrawal of the sample from the seal bars is initiated.

D-2.7 Dwell Time — The time interval during the seal phase when the sealing bars are in contact with, and exerting pressure on the films being sealed.

D-2.8 Heat Seal (Hot-tack) Strength — Force per unit width of a seal needed to peel apart a hot seal measured at a specified time interval after sealing but prior to the temperature of seal reaching ambient. The desired outcome of the test is to peel apart the seal formed by the test instrument. Other types of film failure in the tensile phase of the instrument test cycle may not represent hot-tack strength.

D-2.9 Heat Seal (Hot-Tack) Curve — A plot of measured seal strength as a function of sealing temperature at a fixed dwell time and sealing pressure.

D-2.10 Heat Sealability — The ability of thermoplastic polymers and blends, when comprising a sealing surface of a flexible film, that defines how well the material bonds to itself or a dissimilar material upon the application of pressure, heat, and dwell (time), as judged by the heat seal curve.

D-2.11 Seal Initiation Temperature — Sealing temperature at which a heat seal of minimum measurable strength is produced.

D-2.12 Sealing Interface — Interface of the two film surfaces being sealed.

D-2.13 Sealing Pressure — Force per unit area of seal applied to the material by the sealing bars during the sealing process, with simultaneous transfer of heat, to fuse two surfaces together to form a seal.

D-2.14 Sealing Temperature — Maximum temperature reached at the interface between the two film surfaces being sealed during the dwell time of the sealing cycle.

D-2.15 Withdrawal Time — Time interval from the end of the delay phase to the beginning of the peel of the hot seal.

D-2.16 Ultimate Seal Strength — Final value of strength that is reached after the heat seal has both cooled to ambient temperature and achieved stability in strength.

D-3 APPARATUS

Hot-tack tester is used for testing the hot seal strength under accurately controlled conditions. This test method measures the hot seal strength of flexible films.

D-3.1 Capabilities

An automated sealing and tensile testing instrument having the following minimum capabilities:

i) Equipped with two heated seal bars (seal bar width of 10 mm each) for making heat-seals;
ii) User- selectable and precise control of seal bar temperatures, sealing pressure and sealing dwell time;
iii) Automatic activation of the withdrawal and pull cycles when seal bars open;
iv) User-selectable constant rate of grip separation;
v) Electro-mechanical system to measure the force required to peel apart the seal;
vi) Display of observations and measurements in SI units; and
vii) A suitable computing system, software and display screen to control a foresaid operations, calculations of responses and display of the results in digital and graphical format.

D-3.2 Test Parameter Setting

A wide range of setting for each test parameter enables testing of various materials to suit each application:

i) Sealing temperature for top and lower sealing jaws, set individually;
ii) Sealing pressure;
iii) Sequence timers for Dwell time and Delay time;
iv) Grip separation rate or peeling speed; and
v) Output configuration and recording.

D-3.3 Calibration

Calibration of the hot-tack tester shall be performed in accordance with the equipment manufacturer’s instructions and should include, seal bar temperature, seal bar pressure, phase times (dwell time, delay time and withdrawal time), peeling rate and force measurement transducer. The interval between calibrations shall be determined based on the frequency of use and stability of calibration.

D-4 PREPARATION OF TEST SPECIMEN

D-4.1 Sample Shape and Size

D-4.1.1 The test specimens shall consist of rectangular strips of uniform width 25 mm and specimen length 300 mm. Tolerance shall be ±0.5 percent. A width-thickness ratio of at least 8 shall be used.

D-4.2 Sample Preparation

D-4.2.1 The film specimen shall be uniform in thickness, texture and shall be free from folds, tears, gels, pin-holes and particles of foreign matter which are likely to cause premature failures. The edges shall be parallel to within 5 percent of the width over the length of the specimen between the grips.

D-4.2.2 Wherever possible, the test specimens shall be selected such that thickness is uniform to within 10 percent of the thickness over the length of the specimen between the grips in the case of materials 200 microns or less in thickness and to within 5 percent in the case of materials greater than 200 microns in thickness but less than 1 000 microns in thickness.

D-4.2.3 Specimens shall be prepared by cutting test material in the Machine Direction (MD). For cutting of specimens, devices that use razor blades have proven especially suitable for materials having an elongation-at-break above 10 to 20 percent. The use of punch press or striking dies is not recommended because poor and inconsistent specimen edges may be produced.

D-5 TEST PROCEDURE

D-5.1 Operation Sequence of Test

The hot-tack tester simulates heat sealing on an automatic packaging machine. It makes a hot seal and stresses it under pre-programmed conditions.

D-5.1.1 First the operator selects the desired test parameter values in the monitoring system supported with suitable software by using the keyboard. The film sample is then first fixed in the lower specimen grip which is connected to a peeling actuator and then the other end is fixed in the upper specimen grip which is connected to a load cell transducer. The testing sequence is then activated, and the lower sample grip is moved to its upper position. The sample is automatically folded between the sealing bars with a special specimen fold insertion mechanism. The hot sealing bars maintained at pre-set temperature start closing to the pre-set sealing pressure and after the pre-set dwell time elapsed, the seal bars open. At the end of the sealing time, and after a pre-set delay time elapsed, the peeling actuator with lower specimen grip moves down with a pre-set test speed and peels the hot seal totally apart. During peeling, the force transducer attached to the upper specimen grip measures the hot-tack force. The signal from the transducer is transmitted to the computing system to initiate data processing, displaying and storing of the test data. The maximum force required to peel apart the seal is the hot-tack force at a given seal temperature.

D-5.1.2 Two sample strips are sealed by applying pressure from seal bars under defined conditions of temperature, pressure and contact time (dwell time). The strips may be either the same film or dissimilar films. Some instrument designs allow the use of a single strip of film which is cut during the sealing phase to form two strips.

D-5.1.3 The grips are specially designed for easy attachment of the sample. The clamping plates of the grips are automatically activated and firmly hold the sample during the test. Vertical movement of lower grip is controlled by an electric motor that enables accurate positioning and speed. The fully automatic folding device provides perfect alignment of sample for sealing process and a fully operator-independent operation.

D-5.1.4 Both seal bars shall be heated at a selected temperature to achieve a good quality seal. The seal bar faces may either be smooth or textured and may be coated or covered with a material to promote easy release from the hot film. The sealing bars are teflon coated to prevent sample sticking. The sealing bars include integrated heating elements and thermocouples to keep the selected sealing temperature constant regardless of the ambient temperature.

D-5.1.5 When the bars of the sealing unit open, the sealed strip specimen is automatically withdrawn from between the seal bars by retraction of the grips holding the ends of the specimen.

D-5.1.6 As the grips move apart at a set speed and the sealed sample is peeled to eventual failure at the seal, the maximum force required to peel apart the seal is measured by the testing machine.

D-5.1.7 The computing system record and store the test data and plots the measured hot seal strength versus sealing temperature and report the sealing temperature at which the maximum hot seal strength (hot-tack) is observed.

D-5.2 Test Procedure

D-5.2.1 Check the availability of compressed air with desired pressure.

D-5.2.2 Ensure the sealing bar surfaces are clean before test.

D-5.2.3 Turn on the computing and monitoring system of the testing equipment and open the hot-tack test software.

D-5.2.4 After initialization of software, enter preset values of sealing parameters to the machine controller. Sealing conditions for hot-tack testing shall be the same for all makes and types of test equipment.

a) *Temperature* — Set both sealing bars to the same temperature, which may vary depending on the properties of the material under test. In running a hot-tack curve, seal temperature is set initially just below the softening temperature and typically increased in 5 ºC to 10 ºC intervals, to locate maxima or other features of the curve, smaller steps of temperature increase may be desirable.

b) *Dwell time* — Must be long enough for the sealing interface to come to the set temperature of the seal bars, which depends on the thickness and construction of the material. The dwell time for testing shall be set at 1 s.

c) *Sealing pressure* — The sealing bar pressure shall be maintained at 30 N/cm^2.

d) *Sealing area* — The sealing area shall be fixed that is, 10 mm x 25 mm.

D-5.2.5 Clamp the specimen strip to be tested in the bottom and then in the top grip, observing alignment precautions and proper orientation of the heat-seal side in accordance with seal test requirements.

D-5.2.6 Enter the desired instrument cycle parameters into the machine controller. Following parameters are commonly used for routine hot-tack testing but may be varied over the ranges provided by each machine manufacturer, depending on the intended application of the data. Values of all instrument cycle parameters must be included in the report.

The other test parameters are:

a) *Delay time* — 0.1 s.

b) *Clamp separation rate* — 200 mm/s.

D-5.2.7 Start the machine. It will progress through the sealing, delay, withdrawal, and hot-tack strength testing phases of the test cycle and automatically record and store numerical test data.

D-5.2.8 After all specimens have been tested at the current temperature level, set the machine to the next temperature level and proceed with testing to develop data for the hot-tack curve. Leave all other variables constant. Continue the testing with a stepwise increase in temperature levels till a progressive decrease in the force to failure is observed. In this region of the curve, the specimen can fail by a variety of non-peel methods, such as excessive stretch, breaking, tearing, distortion, shrinkage, or burn through, etc.

D-5.2.9 When a hot-tack strength is being measured at a series of sealing temperatures, a minimum of three replicates shall be used to determine the mean value at each temperature. When the measurements are not part of a series where an identifiable trend is expected, a minimum of five replicates shall be employed.

D-5.2.10 Remove strip from grips. Observe and record the mode of specimen failure. For meaningful evaluation and comparison of materials and with all types of testing machines, this step is essential. The mode of failure shall be determined visually for each specimen tested in accordance with the following or a similar classification, and the results shall be included in the test report.

The broad classification of failure modes include:

a) Adhesive peel failure of the seal;
b) Cohesive failure of the material;
c) Delamination of the surface layer (s) from the substrate;
d) Break of material at seal edge;
e) Break or tear of material remote from seal;
f) Elongation of material; and
g) Peel with elongation of the material.

Refer to Fig. 2, for failure mode details.

D-5.2.11 If molten plastic sticks to the seal bars, heat up the bars above the melting point of the polymer and do the cleaning with a clean and dry, linter-free soft cotton cloth.

D-5.2.12 Before shutting down bring the seal bars temperatures to ambient by a selection of suitable test conditions as above.

D-5.2.13 Turn off the electric power of the machine.

D-6 CALCULATIONS

Computer-controlled versions of the testing machines do all the necessary calculations automatically and graphically illustrate test data.

D-7 REPORT

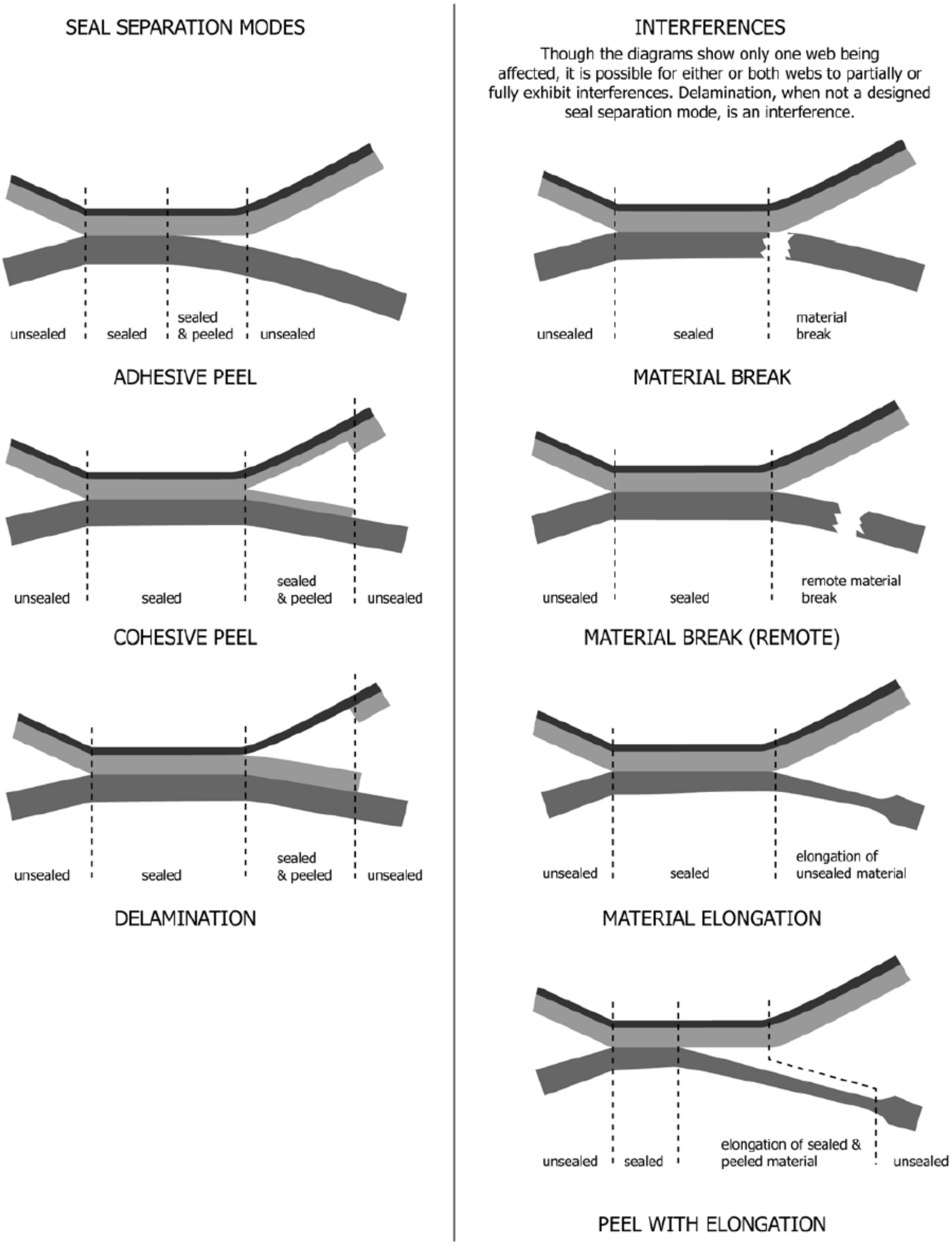
Report the following information with values:

a) Hot seal strength (hot-tack) — maximum peel force recorded for hot seal strength, N/mm.

b) Hot-tack initiation temperature — temperature where a low but measurable hot-tack strength is obtained, ºC.

c) The hot-tack temperature range — (the temperature range, ºC from minimum to maximum temperature where seals with medium hot-tack strength, exceeding 6 N/25 mm are produced).

d) Test specimen failure mode (as per Fig. 2).



SEAL SEPARATION MODES

INTERFERENCES

Though the diagrams show only one web being affected, it is possible for either or both webs to partially or fully exhibit interferences. Delamination, when not a designed seal separation mode, is an interference.

ADHESIVE PEEL

COHESIVE PEEL

DELAMINATION

MATERIAL BREAK

MATERIAL BREAK (REMOTE)

MATERIAL ELONGATION

PEEL WITH ELONGATION

FIG 2 SCHEMATIC REPRESENTATION OF TEST STRIP FAILURE MODES

ANNEX E

(*Clause* 7.5.10)

INK ADHESION TEST FOR PRINTED BAGS

E.1 PROCEDURE

E-1.1 Apply two strips of 25 mm wide transparent pressure sensitive tape or cellophane adhesive tape to the printed area of the bag, one piece running across the length and the other running across the width of the bag. Press the adhesive tape firmly on to the bag and leave it for 15 s.

E-1.2 Remove the tape by pulling slowly at about 1 cm/s pulling rate from one end at 90° to the bag surface.

E-2 RESULT

E-2.1 There shall be no removal of the print from the surface of the bag and the print shall be legible to the naked eye after the test.

ANNEX F

(*Clause* 7.5.11)

DROP IMPACT TEST FOR FILLED BAGS

F-1 PRINCIPLE

F-1.1 The test procedure is used to determine the drop impact performance of the filled bag. This test simulates the bag performance during end-use applications such as repeated handling and drops impacting of bag undergoing during loading, unloading and stacking operations.

F-1.2 In drop impact testing, the filled bag is raised above a rigid surface and released to strike this surface after a horizontal free fall. The atmospheric conditions, the height of the drop and the position of the package are set in advance.

F-2 FILLING BAGS FOR TESTING

Bags shall be filled with a material with the intended commodity or, if this is not possible, with similar material to provide the same degree of filling. The bulk density and mass of this filling material, if used, shall be within ±2 percent of the values for the material to be packed with which the bag is intended to be used. Ensure that the top and bottom closure welds shall be comparable in performance to the FFS process.

F-3 CONDITIONING

Filled and sealed bag samples shall be conditioned for a minimum of 2 h before the drop impact test, in accordance with the conditioning parameters given in **6**.

F-4 APPARATUS

The apparatus necessary to carry out the drop test shall include the following:

F-4.1 Bag lifting arrangement, which will not damage the bag during either lifting or release.

F-4.2 Means of holding the bag prior to release in its predetermined height and position. The difference in the behavior of a bag suspended from the top side or supported underneath in a bottom edge drop can be significant, and the method of holding the bag before dropping shall be included in the test report.

F-4.3 Release mechanism to release the filled bag in such a way that its fall is not obstructed by any part of the apparatus before striking the hard impact surface.

F-4.4 Impact surface shall be horizontal to the ground, flat and massive enough to be immovable and rigid enough to be non-deformative under test conditions. In normal circumstances, the impact surface provided shall be sufficiently large to ensure that the bag falls entirely upon the impact surface and shall be of one piece, with a mass at least 50 times that of the heaviest bag to be tested.

F-5 DROP IMPACT TESTING OF BAGS

F-5.1 Drop testing shall be carried out using a suitable bag drop mechanism. Each bag shall be dropped from a height of 3.0 m for the test requirements as follows:

a) Height of drop = 3.0 m (one time for face side and one time for back side);

b) Height of drop = 3.0 m (one time for left edge and one time for right edge); and

c) Height of drop = 3.0 m (one time for bottom edge and one time for top edge).

F-5.2 As given in Fig. 3, place the bag under test centrally on the platform which is within ± 2 percent of the predetermined drop height as defined by the distance between the lowest point of the bag at the time of drop release and the nearest point of the impact surface.

F-5.3 The bag shall be released from its predetermined position within the following tolerances:

a) For drops on any side, the impacting surface of the bag shall be parallel, to within 2° to the impact surface;

b) The velocity of the bag at impact shall be within ±1 percent of that which would be achieved by a free fall.

F-6 CRITERION FOR PASSING THE TEST

F-6.1 After each drop there shall be no rupture or loss of contents. A slight discharge for powder material from micro perforations, upon impact shall not be considered a failure of the bag provided that no further leakage occurs after the bag has been raised clear of the ground.

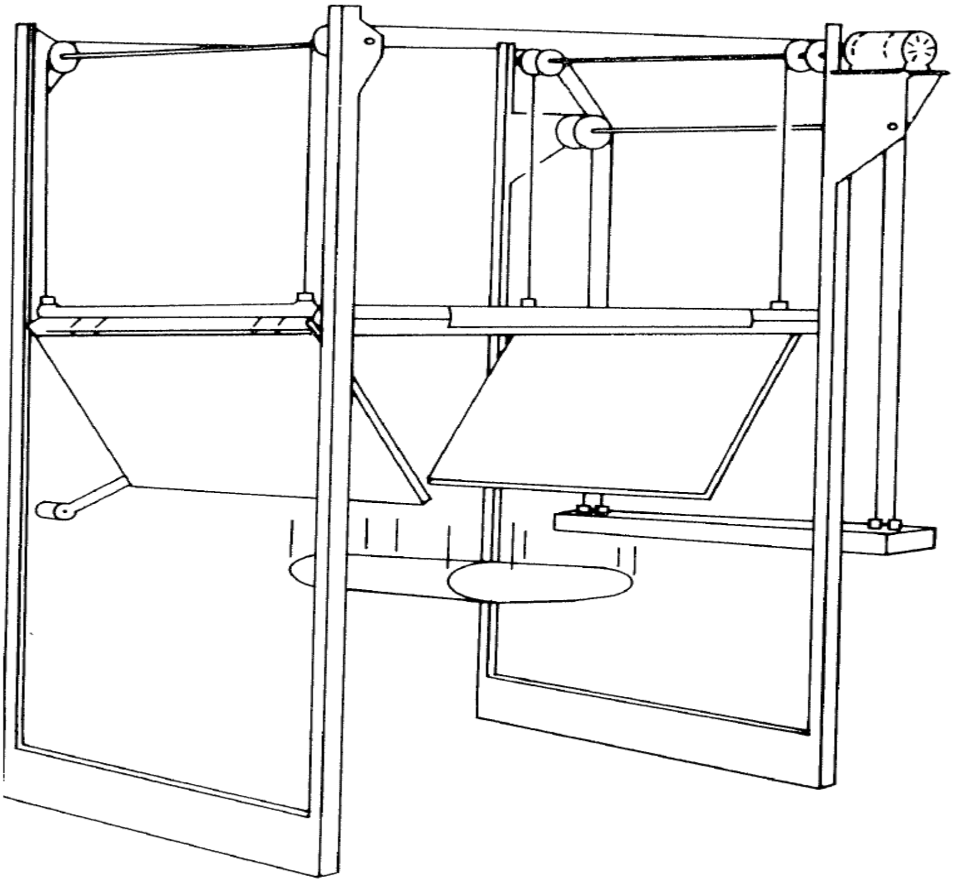


FIG. 3 EXAMPLE OF APPRATUS FOR DROP IMPACT TEST FOR FILLED BAGS

ANNEX G

(*Foreword*)

COMMITTEE COMPOSITION

Plastics Packaging Sectional Committee, PCD 21

Organization(s)	*Representative(s)*
In personal Capacity	Prof (Dr) N. C. Saha (***Chairman***)
All India Food Processors Association (AIFPA), Delhi	Shri Mohit Chaudhary
All India Plastics Manufacturers Association (AIPMA), Mumbai	Shri Kailash B. Murarka Shri Kishore Sampat (*Alternate*)
Bisleri International Pvt Ltd, Delhi	Shri K. Ganesh, Ms Saloni Chadha (*Alternate*)
Central Institute of Plastics Engineering & Technology (CIPET), Chennai	Dr S. N. Yadav, Dr Smita Mohanty (*Alternate*)
Chemco Plastic Industries Private Ltd, Mumbai	Shri Gaurav Saraogi Shri Rupande Sampat (*Alternate*)
Chemicals and Petrochemicals Manufacturers Association (CPMA), New Delhi	Shri Mahinder Singh Dr Kanak B Das (*Alternate*)
Coca-Cola India, Gurgaon	Shri Virendra Landge Shri Rajendra (*Alternate*)
Confederation of Indian Food Trade & Industry (FICCI), New Delhi	Shri Manoj Mehta
CSIR-Central Food Technological Research Institute (CFTRI), Mysore	Dr Rajeshwar Matche Dr Arun P. Selvam (*Alternate*)
CSIR-Indian Institute of Toxicology Research, Lucknow	Dr V. P. Sharma, Dr A. B. Pant (*Alternate*)
Essel Propack Limited, Mumbai	Shri Hariharan K. Dr Gurunath (*Alternate*)
Federation of Indian Packaged Drinking Water Manufacturers Association (FIPMA), Mumbai	Shri Apurva Doshi
Foundation for Innovative Packaging and Sustainability (FIPS), Mumbai	Shri M. K. Banerjee
FSSAI, New Delhi	Dr Dhir Singh
GAIL India Ltd., NOIDA	Shri Manish Khandelwal Shri Nitin Gupta (*Alternate*)
Haldia Petrochemicals, Kolkata	Shri Raj K. Datta, Shri Srikanth Ramani (*Alternate*)
HPCL— MITTAL Energy Limited (HMEL), Noida	Shri Vineet K Gupta Shri Alakesh Ghosh (*Alternate*)
IIT Roorkee-Saharanpur Campus	Dr Yuvraj Singh Negi
Indian Centre for Plastics in the Environment (ICPE), Mumbai	Shri T. K. Bandopadhyay
Indian Institute of Packaging, Mumbai	Dr Tanweer Alam Shri Madhab Chakraborty (*Alternate*)

Organization(s)	*Representative(s)*
Indian Oil Corporation Limited (IOCL), R&D, Panipat	SHRI DHANANJAY SAHOO SHRI PONNUSWAMY K. (*Alternate*)
Ministry of Food Processing Industries, New Delhi	ER ANAND KISHORE
National Association for Feeders and Nipples Industries (NAFNI), Mumbai	SHRI HARISH SHROFF, SHRI ASHOK ANEJA (*Alternate*)
National Dairy Development Board, Anand	SHRI P. K. PUNDIR, SHRI S. K. GOSWAMI (*Alternate*)
Nestle India Ltd, New Delhi	SHRI BARUN BANERJEE, SHRIMATI SARITA DEVI (*Alternate*)
PET Packaging Association for Clean Environment (PACE), New Delhi	DR VIJAY HABBU SHRI PANKAJ UPPAL (*Alternate*)
Pigeon India, Grater Noida	MS SIMPLE BAJAJ MS SNEHA GUPTA (*Alternate*)
Reliance Industries Ltd, Mumbai	SHRI S. V. RAJU DR SUNIL MAHAJAN (*Alternate*)
Shriram Institute for Industrial Research, Delhi	SHRI N. A. HASHMI DR A. K. TYAGI (*Alternate*)
Skypack India Pvt. Ltd, Haryana	SHRI NAVEEN TALWAR SHRI JAGBIR SINGH (*Alternate*)
Sumitomo Chemical India Ltd, Mumbai erstwhile Excel Crop, Mumbai	SHRI PRASAD GHATE
Sun Pharmaceutical Industries Ltd (Sun Pharma), Mumbai	SHRI SHANTANU CHOWDHARY
Uflex, Noida	SHRI JEEVRAJ PILLAI SHRI RAHUL DUBEY (*Alternate*)
Voluntary Organization in Interest of Consumer Education (VOICE), New Delhi	SHRI M. A. U. KHAN SHRI H. WADHWA (*Alternate*)
BIS Director General	SHRIMATI MEENAL PASSI, SCIENTIST 'E' AND HEAD (PCD) [REPRESENTING DIRECTOR GENERAL (*Ex-Officio*)]

Member Secretary
SHRI SHIVAM DWIVEDI
Scientist 'B' (PCD), BIS

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Bureau of Indian Standards

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